Non-Fossil Solutions to Reliability: Case Studies from California

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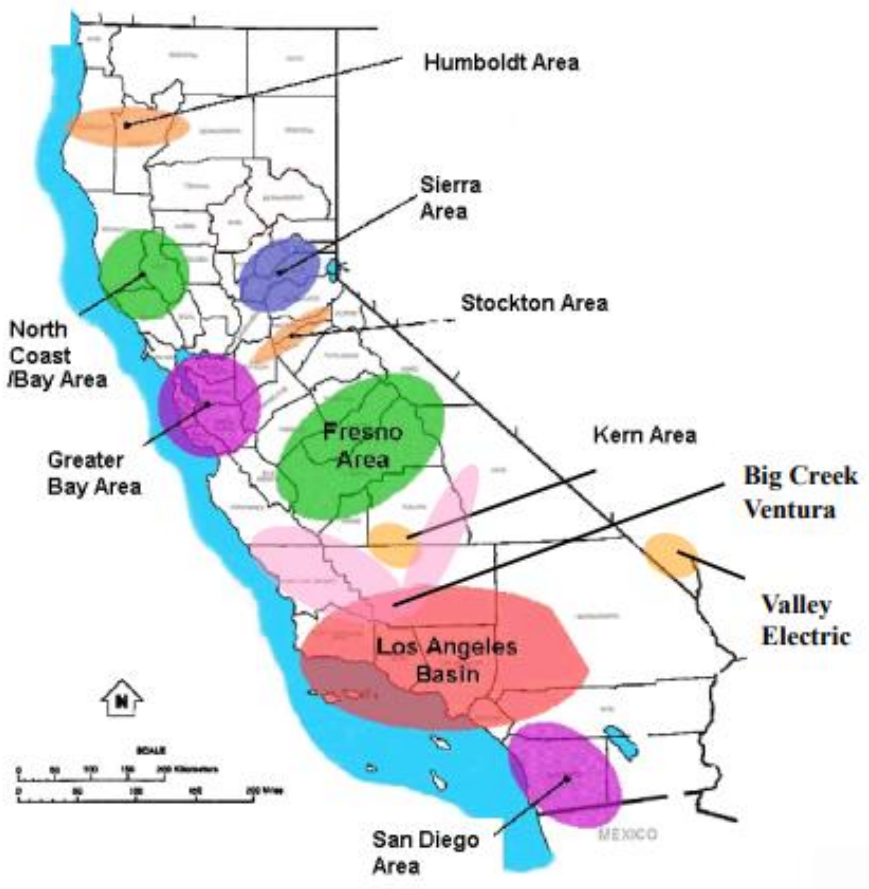
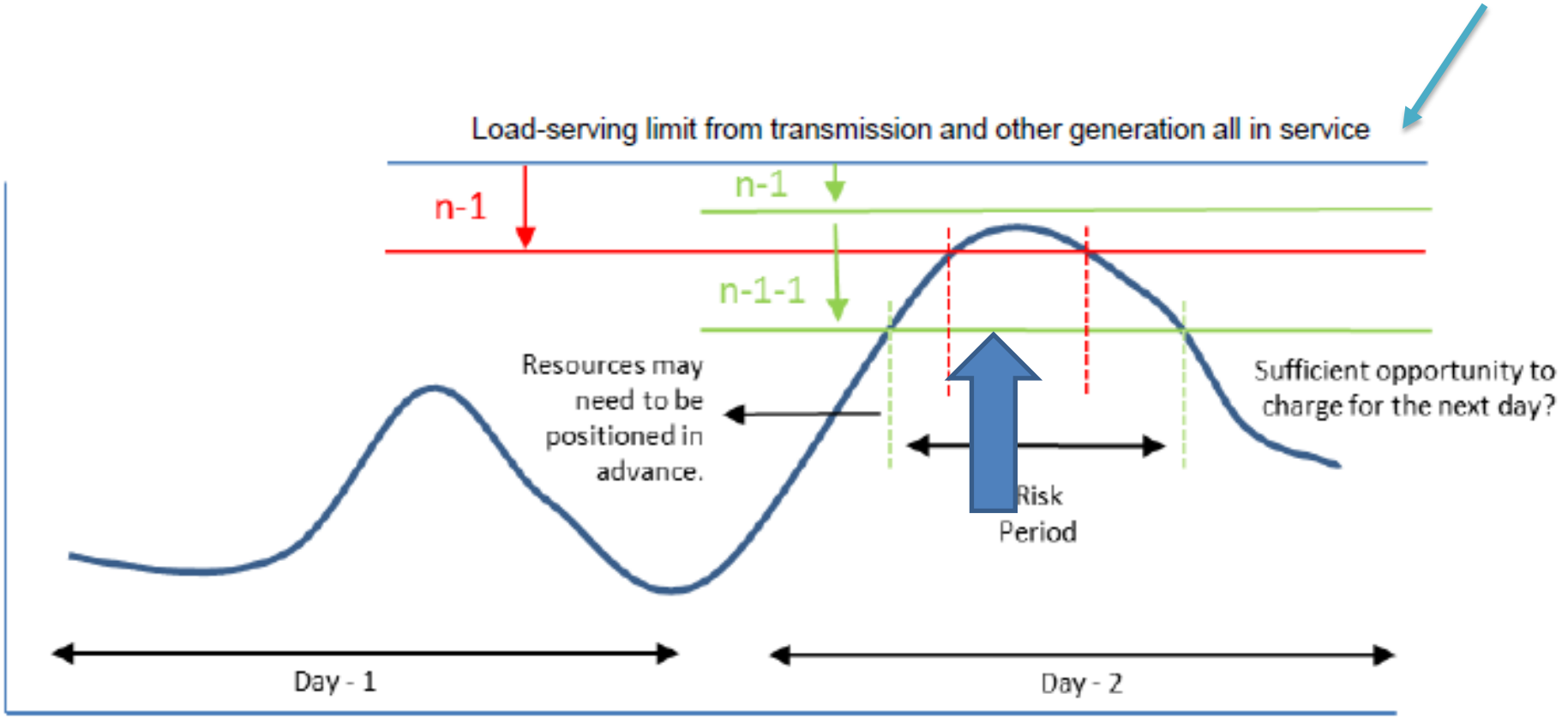
California Capacity Requirements

- **System**
  - Peak load + 15 %
  - 47,484 MW in 2017
- **Local**
  - N-1-1 on 1-in-10 peak day
  - 20,964 MW in 2017
- **Flex**
  - Largest 3-hr ramp in month

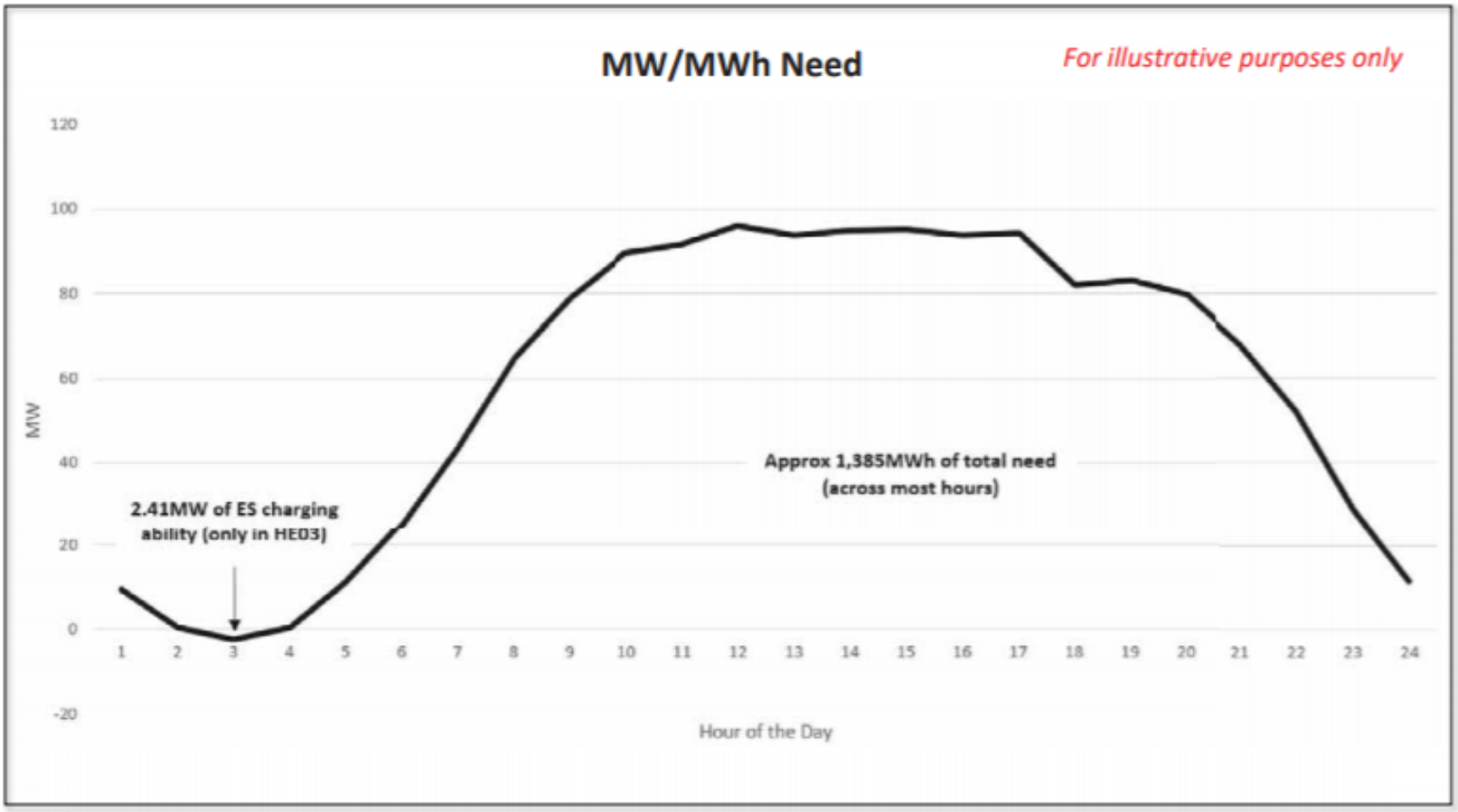


Breaking Down Local Capacity

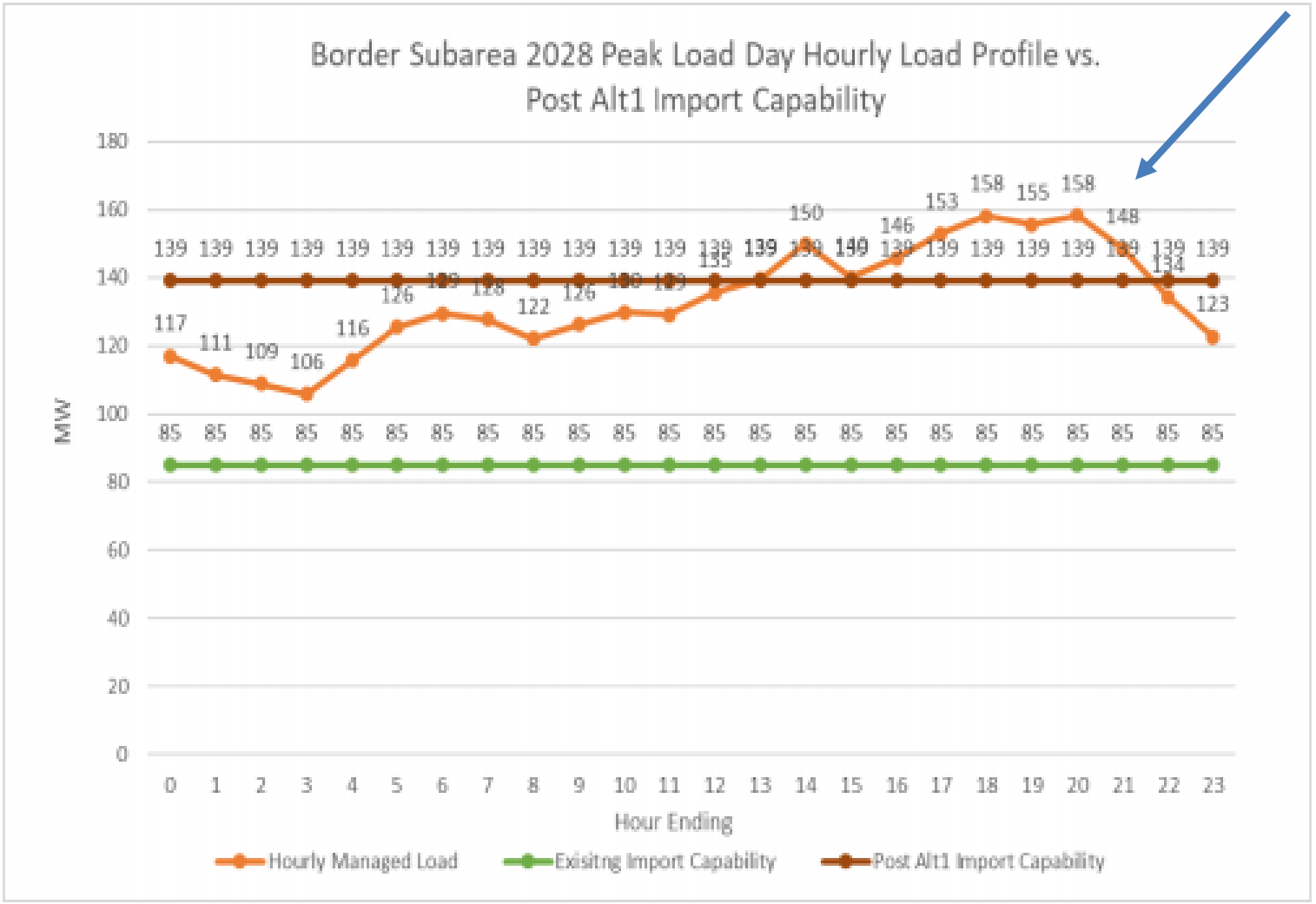
Local area planning means considering impacts of single and multiple contingencies – and outage durations:



Meeting Local Capacity Depends on Import Capability and Load Curve

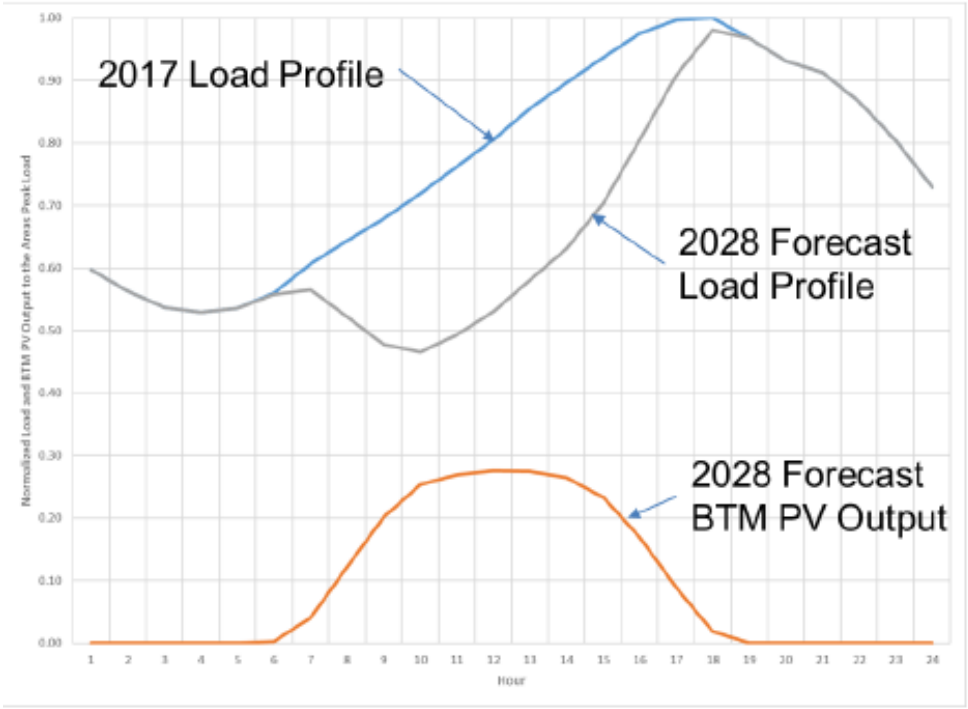


Transmission Upgrades May Be Part of Solution



(Rooftop) Solar Narrows Load Curve

The peak daily demand is also becoming narrower in many areas – largely due to behind the meter generation



Example: Greater Bay Area

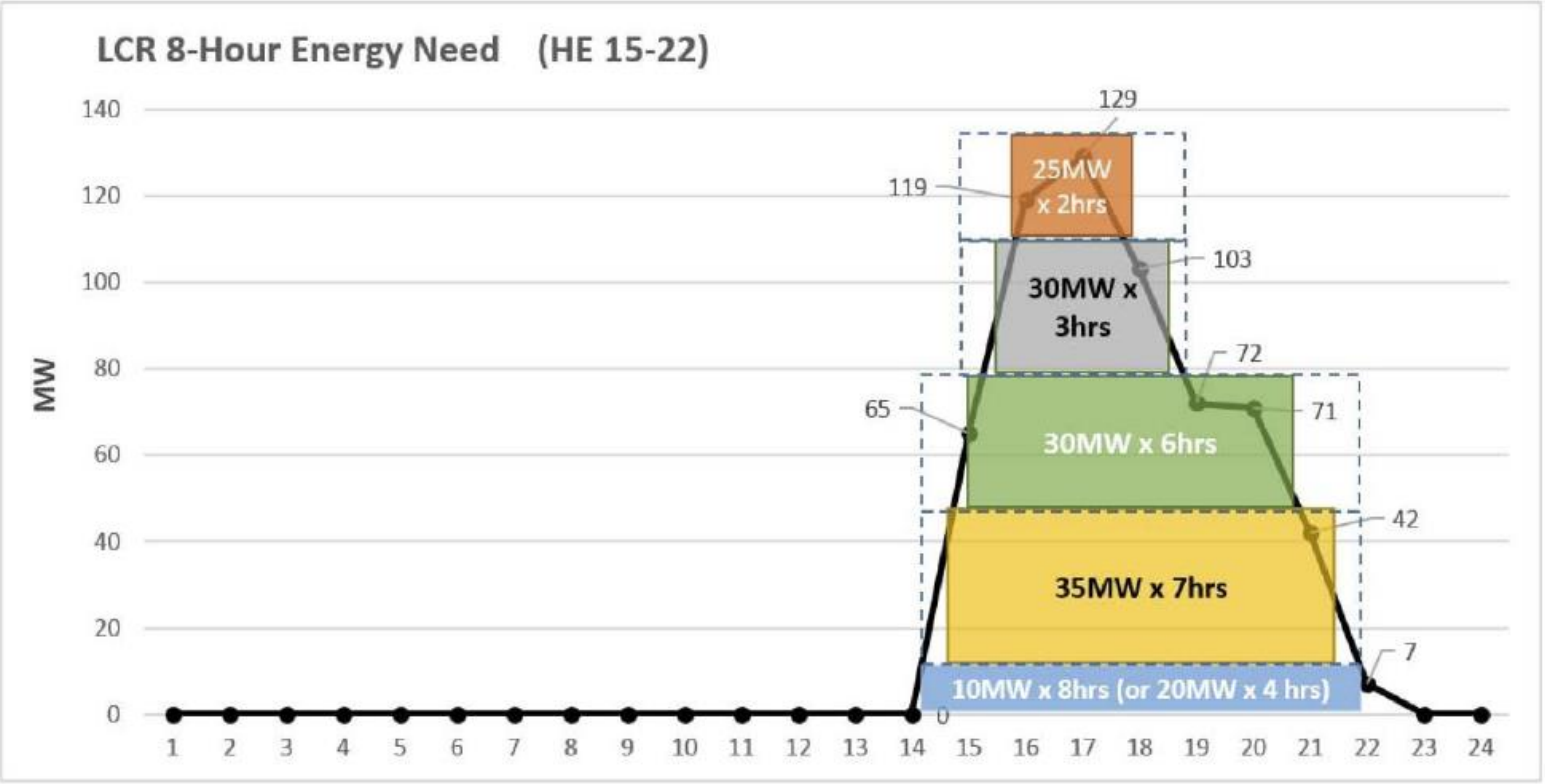
Puente

Puente Alternative: Transmission + Storage

Transmission Upgrade: Cut Need in Half to 102-164 MW

Energy Storage for Remainder:

- Total MWh to meet load duration curve
- Departure from traditional 4MWh local capacity product (195MW/780 MWh for 162 MW local capacity)



Oakland Clean Energy Initiative

Oakland Dynegy Power Plant is approaching retirement age

- Began commercial operations in 1978
- Operates under a Reliability Must Run (RMR) Contract with the California Independent System Operator

In the 2015-2016 Transmission Planning Cycle, CAISO identified the retirement of the Oakland Power Plant as a long-term reliability concern for the East Bay Area

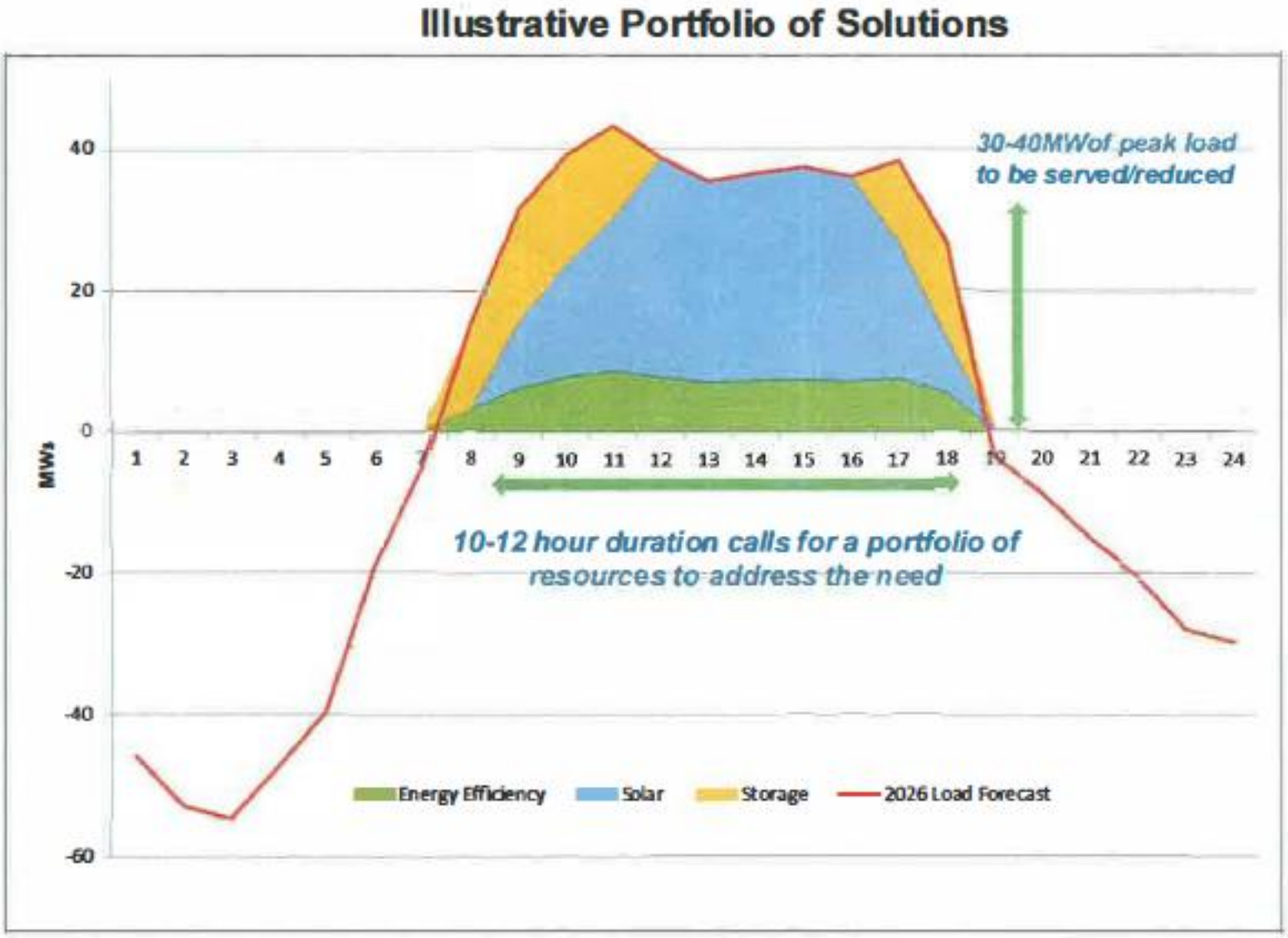
PG&E submitted an Oakland Reliability Proposal to CAISO in Sept 2017, which was approved in March 2018

Pacific Gas and Electric Company

Oakland Clean Energy Initiative

	Solution Description	Considerations
Status Quo 	• Continue to rely on the existing plant or repower the plant with new gas turbines	• Power plant nearing retirement age • Risk of catastrophic failure • Local air quality concerns
New Transmission 	• New 115kV or 230 kV transmission line	• New underground (5-6 miles) and overhead (3-4 miles) transmission • Multi-year effort that would require digging through downtown Oakland
OCEI 	• A portfolio of traditional utility investments & operational solutions, FTM Energy Storage, and additional procured DERs	• Clean and innovative solution • Potentially most cost effective • CAISO preferred approach

Oakland Clean Energy Initiative



Market Power Mitigation: Metcalf RMR

TABLE A2: 2018

Local Areas							
Greater Bay							180
Llaga							
San Jose	568	488	86%	568	111	20%	

Storage will replace 3 California gas plants as PG&E nabs approval for world's largest batteries

Met
Scru

September

By Gavin Bade

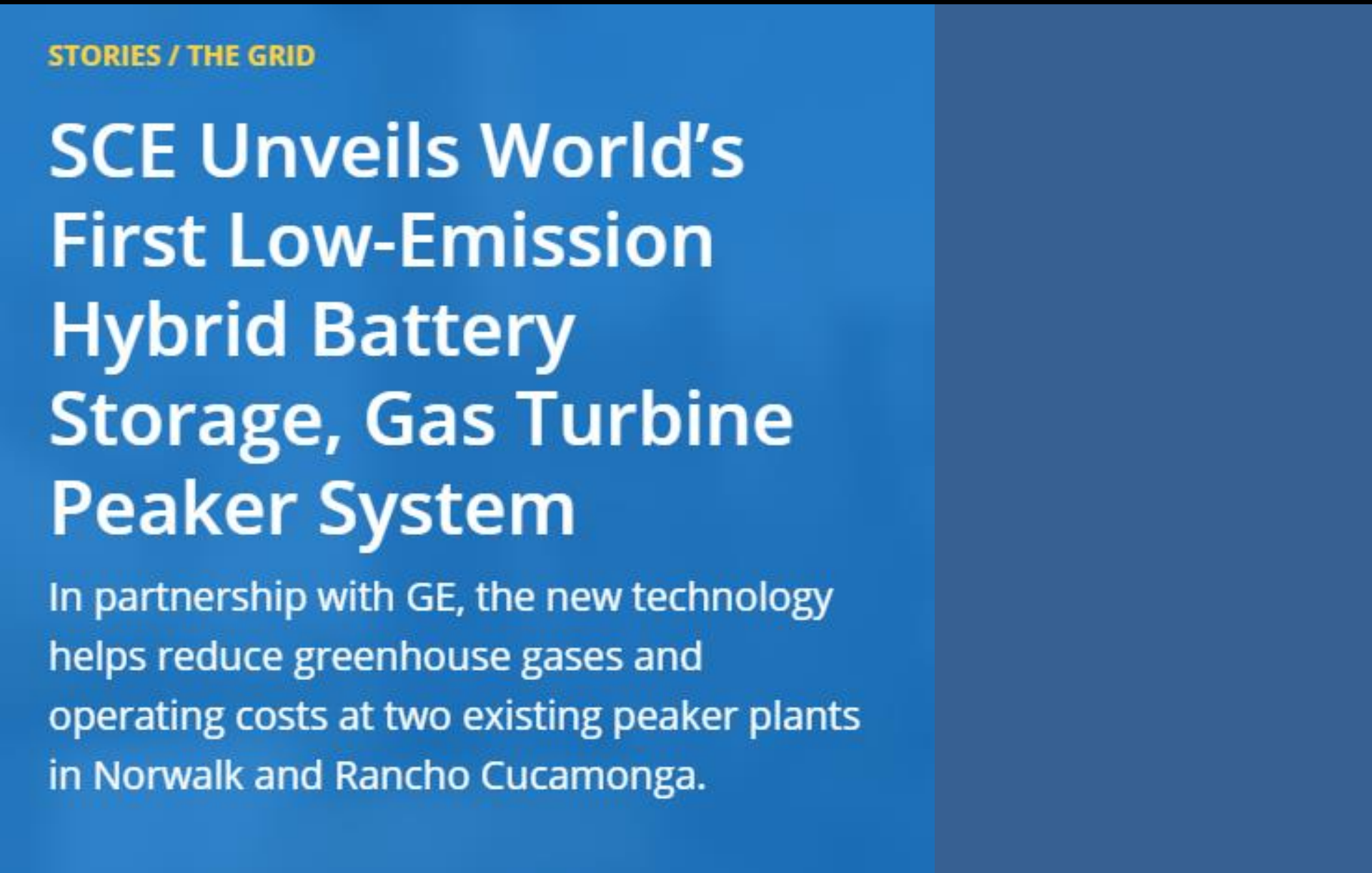
Published Nov. 9, 2018

PG&E Must Solicit Energy Storage and DERs to Replace 3 Existing Gas Plants

Regulators rejected an effort to secure lucrative payments for the uneconomical Calpine gas plants.

JULIAN SPECTOR | JANUARY 15, 2018

Gas/Storage Hybrids



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